YELLOWSTONE COUNTY

REQUEST FOR PROPOSAL

FOR

DUNN MOUNTAIN COMMUNICATIONS TOWER REPLACEMENT

OCTOBER 2020

REQUEST FOR PROPOSALS FOR DUNN MOUNTAIN COMMUNICATIONS TOWER REPLACEMENT

The Yellowstone County Board of County Commissioners is requesting proposals from qualified firms to provide all services, labor, materials and equipment for dismantling and removal of the current 185 foot guy-wired antenna, construction of a new identical 185 foot guy-wired load bearing antenna with proper grounding, and moving antennas to new tower and provide new coax cables. Proposals submitted must have Three (3) hard copies and one (1) electronic copy of the written response to this RFP clearly marked **"RFP DUNN MOUNTAIN TOWER REPLACEMENT"** and is received no later than 5:00 P.M. MDT on October 26th, 2020. All Proposals received will be time and date stamped. All timely proposals will be opened and acknowledged at 9:30 a.m. October 27th, 2020 in the Commissioners Board Room, 3rd Floor – Room 3108, Stillwater Building, located at 316 North 26th Street, Billings, MT 59101. All proposals that are time and date stamped later than 5:00 p.m. October 26th, 2020 will not be considered.

Information concerning this request should be addressed to James Matteson, Yellowstone County Purchasing, *jmatteson@co.yellowstone.mt.gov.*

SELECTION PROCEDURE

The County intends to evaluate and award a contract for the project without conducting discussions. However, the County reserves the right to conduct discussions if determined by the County to be in the best interest of the County at any time leading up to contract award.

EVALUATION

The evaluation of Consultants' proposals may include, but is not limited to, the following criteria:

- Capability to meet time and project budget requirements
- Recent and current work for the County
- Present and projected workloads
- Qualifications of professional personnel to be assigned to the project
- Related experience on similar projects
- Location

EVALUATION CRITERIA

The proposals being requested will be scored on the following criteria:

Qualifications and Ability to Perform Requested Services (100 Points Total)

- Past Experience and Performance on County Projects – 40 Points
- Staff Qualifications – 40 Points
- Proposal Methodology and Approach – 20 Points

Total Points **100 points**

SUBMITTAL OF INFORMATION:

Three (3) hard copies and one (1) electronic copy of the written response to this RFP, following submittal instructions, clearly marked **RFP DUNN MOUNTAIN TOWER REPLACEMENT** and be received no later than 5:00PM MDT on October 26th, 2020.

Board of County Commissioners
Room 3101
316 North 26th Street
Billings, MT 59101

Project Requirements:

- Finalize design requirements
- Provide cost estimates throughout design – Schematic Design; Design Development; Construction Documents (SD:DD:CD)
- Responsible design practices that meet established budgets
- Detailed planning/design/phasing
- Permitting through all Authorities Having Jurisdiction (AHJ's)
- Construction Administration

The costs for developing and delivering responses to this RFP and any subsequent presentations of the proposal as requested by the County are entirely the responsibility of the offeror. The County is not liable for any expense incurred by the offeror in the preparation and presentation of their proposal or any other costs incurred by the offeror prior to execution of a contract. All materials submitted become the property of the County.

SCOPE OF WORK

DUNN MOUNTAIN TOWER REPLACEMENT

A. Dismantle and Removal of 185-foot guy-wire radio Tower

B. Removal of existing guy-wire pads, fill and level pad sites

C. Provide and construct new 185-foot guy wired load bearing tower, utilizing Motorola R-56 Requirements for grounding & lightning protection

With new guy-wire pads and new guy-wires.

D. Move existing antennas to the new tower

E. Provide and install new LMR 600 coax cables to new tower

ALTERNATIVE I

A1. Dismantle and Removal of 185-foot-guy-wire radio Tower

A2. Removal of existing guy-wire pads, fill and level pad sites

A3. Provide and install a new 185 foot Self-Supporting Tower, utilizing Motorola R-56 Requirements for grounding & lightning protection

A4. Provide & install Safety Climbing Ladder

A4. Move existing antennas to the new tower

A5. Provide and install new LMR 600 coax cables to new tower

INFORMATIONAL EXHIBITS

Exhibits are attached as part of this Request For Proposal to share information that may pertain to the responses.

Exhibit "A" – Geotechnical Information
Exhibit "B" - Existing Tower Load Criteria to antenna and dishes

The successful bidder (herein after Contractor),shall maintain at its sole cost and expense, commercial general liability insurance naming Yellowstone County, as additional insured against liability for damages for bodily injury, including death and completed operations and property damages in a minimum amount of Seven Hundred Fifty Thousand Dollars ($750,000.00) for each claim and One Million Five Hundred Thousand Dollars , ($1,500,000.00), in the aggregate arising from incidents which occur as the result of Contractors negligence while performing any work or service and for which Yellowstone County, sole basis of liability is vicarious liability for the acts or omissions of the Contractor or/and subcontractors. Contractor shall maintain at its cost and expense, insurance against claims for injuries to persons or damages to property, including contractual liability which may arise from or in connection with work or service by Contractor, agents, employees, representatives, assigns and sub-contractors. This insurance shall cover claims as may be caused by any negligent act or omission. The policy of insurance shall be an occurrence policy with a Best Rating of A- or better and must be in force throughout the period.

Contractor shall name on the Certificate of liability insurance Yellowstone County, as additional insured for on-site work or Maintenance Service. In addition, Contractor will furnish to Yellowstone County a copy of the policy endorsement, CG 32 87 05 10, indicating that Yellowstone County, are named as an additional insured under the Contractors insurance policy. Contractor agrees to furnish both the Certificate of insurance and policy endorsement at least ten (10) days prior to beginning work.

Contractor agrees to defend, indemnify and hold harmless Yellowstone County from and against any and all claims demands, obligations causes of action, lawsuits and all damages and liabilities fines, judgments, costs, (including settlement costs), and expenses associated therewith (including reasonable attorney's fees and disbursements), arising from incidents that occur the result of Contractors negligence. And for which Yellowstone County, sole basis of liability is vicarious liability for the acts or omissions of Contractor. The defense and indemnification obligations under this paragraph of the Invitation to Bid shall not be limited by any assertions or finding that Yellowstone County, is liable for any damages by reason of a non-delegable duty.

Contractor is required to maintain workers compensation insurance, or an independent contractor's exemption issued by the Montana Department of Labor covering Contractor and Contractor's employees. Contractor is not, nor is Contractor's workers, employees of Yellowstone County. Workers Compensation Insurance or the exemption from the workers compensation obligation must be valid for the entire period.

INSTRUCTIONS TO PROPOSERS

Proposals Must:

1. Be signed by an officer or principal of your firm.
2. Be contained in a document not to exceed eight (8) pages total (single or double-sided printing is acceptable) including whatever pictures, charts, graphs, tables, and text the firm deems appropriate to be part of the review of the firm's qualifications. A separate transmittal letter, cover page, cover sheets, sample schedules, and dividers are exempted from the page limit. The page size is limited to 8.5 x 11 inches, with basic text information reasonably legible.
3. Include a proposed project schedule, which does not count toward the limit.

All questions and contact regarding this RFP must be submitted in writing (Email is acceptable) to:

Yellowstone County Purchasing
Attention: James Matteson
216 North 27th Street
Billings, MT 59101
406-256-2717
jmatteson@co.yellowstone.mt.gov

-END OF THIS REQUEST FOR PROPOSALS-

EXHIBIT "A"
11 page Document

GEOSCIENCE, PLLP
3949 PINE COVE RD, BILLINGS, MT 59102
406.697.3817 OR 406.697.8113
WWW.GEOSCIENCEINC.NET

December 2, 2008

Mr. Jason Black
Sabre Communications
2101 Murray Street
Sioux City, Iowa 51102

RE: GEOTECHNICAL DESIGN SUMMARY FOR THE PROPOSED DUNN MOUNTAIN COMMUNICATIONS TOWER, SOUTH OF ROUNDUP, MONTANA

Dear Jason:

The purpose of this letter is to provide foundation design parameters for the proposed Dunn Mountain communications tower to be constructed south of Roundup, Montana. A 150-foot high, self-supporting tower will be constructed. Additionally, an approximately 200 square foot, single level equipment building will be built adjacent to the tower.

It is our understanding that soil, rock, and groundwater parameters will be provided by this office to Sabre Communications. Sabre Communications will in turn design foundations for the proposed structures.

Investigation

Representatives of GEOSCIENCE were onsite November 24th and December 1st, 2008 to observe the site and conduct a field investigation. Soil and rock type, thickness, consistency, and relative moisture content were documented in the field by a Professional Engineer and Engineering Geologist. Location and Site Maps are included in Attachment 1, Figures 1 & 2.

The tower and associated building sites are underlain by clinker (sandstone bedrock baked by subsurface burning of underlying coal seams) presumably of the Tongue River member of the Fort Union Formation. A geologic map of the site is included as Figure 3, in Attachment 1. The clinker is reddish brown to reddish gray, fine to medium-grained, moderately to highly weathered, very weak to moderately strong, and thinly to medium bedded. In zones, the sandstone has been altered to the consistency of sandy gravel to gravelly sand. Degree of alternation of the clinker may be described as baked to moderately welded.

Based on our observations, it appears excavation with a medium to large track hoe equipped with rock teeth may be suitable for shallow excavations (less than about 7 feet). Excavations deeper than about 7 feet may require alternate methods such as a hydraulic hammer or concrete breaker.

The tower and associated building sites are underlain by clinker (baked sandstone bedrock) or a very thin layer of residual sediments overlying clinker. Subsurface conditions are further described below:

> Residual Soils consisting of silty to poorly graded sand overlying bedrock were observed from ground surface to depths ranging from about 0.5 to 2 feet. The soils are described as loose, dry, and brown with scattered organics and clinker fragments.
>
> Clinker was observed at ground surface and numerous other locations across the site. The clinker is reddish brown to reddish gray, fine to medium-grained, moderately weathered, very weak to moderately strong, and thinly to medium bedded. In zones, the sandstone has been altered to the consistency of sandy gravel to gravelly sand. Clinker is formed where subsurface coal seams burn, likely due to coal outcrops being exposed to range fires. The coal may burn below ground for long periods of time, and consequently burns or bakes the overlying bedrock. Depending on heat and available oxygen, the overlying bedrock may be slightly burned to highly welded.

Estimates of shear wave velocities were used to assess ripability of bedrock materials. Results indicate soil shear wave velocities are on the order of 500 to 1,200 feet per second and clinker shear velocities are on the order of 3,000 to 5,000 feet per second.

Seeps, springs or other indications of groundwater were not observed on November 24th or December 1st, 2008. It does not appear groundwater will influence construction. Moisture conditions are, however, expected to fluctuate in response to seasonal precipitation, runoff, and snowmelt. Soil moisture conditions may increase seasonally. Study of these influences is outside the scope of these services.

Photos of the site and exposed clinker/bedrock are included as Attachment 2.

Foundations

The proposed tower may be supported on a buried mat foundation. Depending on depth, difficulties may include clinker excavation. Allowable design parameters are included in Table 1. Strength parameters for clinker/bedrock material above a depth of 5 feet have been reduce to account for weathering, fracturing, and shallow overburden. The project Structural Engineer should design the mat foundation reinforcement and check lateral loading and over-turning moments. Shallow mat foundations shall be placed a minimum of 48-inches below finished ground surface for frost protection.

Table 1: Design Parameters			
Material Type	**Allowable Bearing (psf)**	**Allowable Passive Pressure (psf)**	**Unit Weight (pcf)**
Overburden 0 to 2'	Ignore	Ignore	90
In-place Clinker 2 to 5'	2,500	350	120
In-place Clinker Below 5'	3,500	600	135
Disturbed/Excavated Clinker used as Perimeter Backfill	Ignore	350	120

Mat foundations shall be placed directly on clean sound bedrock or undisturbed clinker. Soil, loose materials, and slaked debris should be removed from the excavation prior to placing concrete for foundations. Allowable passive pressures for clinker in Table 1 may be used provided concrete is poured directly against intact clinker. If the foundation is formed/poured and then the void between the clinker and concrete mat is backfilled, allowable passive pressures should be based on the backfill material (i.e. lower soil values should be used).

The proposed equipment building may be supported on standard shallow foundations or monolithic thickened-edge slabs. Frost-protected shallow foundations (i.e. thickened-edge-slabs) placed on clean bedrock surfaces or granular structural fill are appropriate if adequately designed and properly constructed in accordance with the American Society of Civil Engineers (ASCE) Standard SEI/ASCE 32-01 *Design and Construction of Frost-Protected Shallow Foundations*.

The thickened edge portion of the slab should be placed on clean bedrock or free-draining structural fill with less than 5% fines.

Excavation

Based on our observations, it appears excavation with a medium to large track hoe equipped with rock teeth may be suitable for shallow excavations (on the order of 7 feet deep). Excavation deeper than about 7 feet may require alternate methods such as using a hydraulic hammer or concrete breaker. A qualified observer should review the foundation excavation prior placement of concrete or fill.

All excavations must conform to OSHA *Standards for Excavations*, 29 CFR Part 1926.652 Appendix B to Subpart P. Based on field observations, the materials at the site are classified as *Type C* and *Stable Rock* using OSHA classification system. *Stable Rock* may be excavated vertically for excavations not exceeding 10 feet in height. Soil overburden above the bedrock should be sloped at an angle not to exceed 1.5 H: 1 V (horizontal to vertical). Depending on moisture conditions during the time of excavation and lateral variability of the soils and bedrock,

materials should be re-classified at the time of construction to help determine required slope angles.

Fill, Fill Placement, Compaction, Site Grading

It is not anticipated that structural fill will be need for this project. If required, structural fill should conform to the following requirements or be approved by the project Geotechnical Engineer. Excavated site materials may be used for perimeter backfill, provided compaction and density are verified.

Table 2
Granular Fill Recommendations

Gradation	Percent finer by weight
3-inch	100
No. 4 Sieve	40–80
No. 200 Sieve	10 Maximum
LL & PI = Non-Plastic	

Structural and perimeter backfill should be placed in maximum 12-inch loose lifts, moisture-conditioned to near optimum moisture content, and compacted to at least 95% of maximum dry density as measured by ASTM D 698. If density tests taken in the fill indicate compaction is not being achieved, fill should be scarified or removed, moisture-conditioned to within ±2 percent of optimum moisture content, and re-compacted and re-tested. No fill should be placed over frozen ground or in a frozen condition.

Care should be taken adjacent to "green" foundation concrete. Over compaction adjacent to "green" concrete may lead to foundation damage and cracking. Under no circumstances shall fill be placed using "hydro"-compaction methods. Excessive water may damage foundation elements.

The recommended minimum slope within 10 feet of the tower foundation is 1 inch vertical for 1 foot horizontal. The sloped ground should be initially constructed at a greater slope to account for settlement/consolidation of exterior backfill.

Subgrade soils and fill should be protected against frost. No concrete or structural fill shall be placed against frozen ground or contain froze materials such as snow or ice. It is the contactor's responsibility to take adequate precautions to prevent damage from frost heave or frozen subgrade.

Seismicity

The project site and general vicinity of Dunn Mountain are in an area of relatively low seismic activity. Seismic design parameters are provided below:

GEOSCIENCE, PLLP
3949 PINE COVE RD, BILLINGS, MT 59102
406.697.3817 OR 406.697.8113
WWW.GEOSCIENCEINC.NET

2% Probability of Exceedence in 50 years:	PGA	0.2 sec SA	1.0 sec SA
	4.0%g	10.0%g	3.0%g

Limitations

The conclusions and recommendations presented in this report assume that site conditions are not substantially different than that observed during the field investigation. If subsurface conditions different from those discussed in this report are observed or appear to be present during construction, Geoscience, PLLP should be advised so that we can review those conditions and reconsider our recommendations where necessary. In addition, we shall review any foundation plans for the project to help determine if the recommendations presented have been followed.

These services have been performed in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in this area under similar conditions. Any conclusions by a contractor or bidder relating to construction means, methods, techniques, sequences or costs based on the information provided in this report are not the responsibility of the Owner, Geoscience, or Sabre Communications.

It is customary for the consultant that provides design recommendations to be retained to provide observation and related services during construction. Recommendations in this report are contingent assume this office will be retained to provide foundation observations, compaction testing and verification, and review of foundation plans.

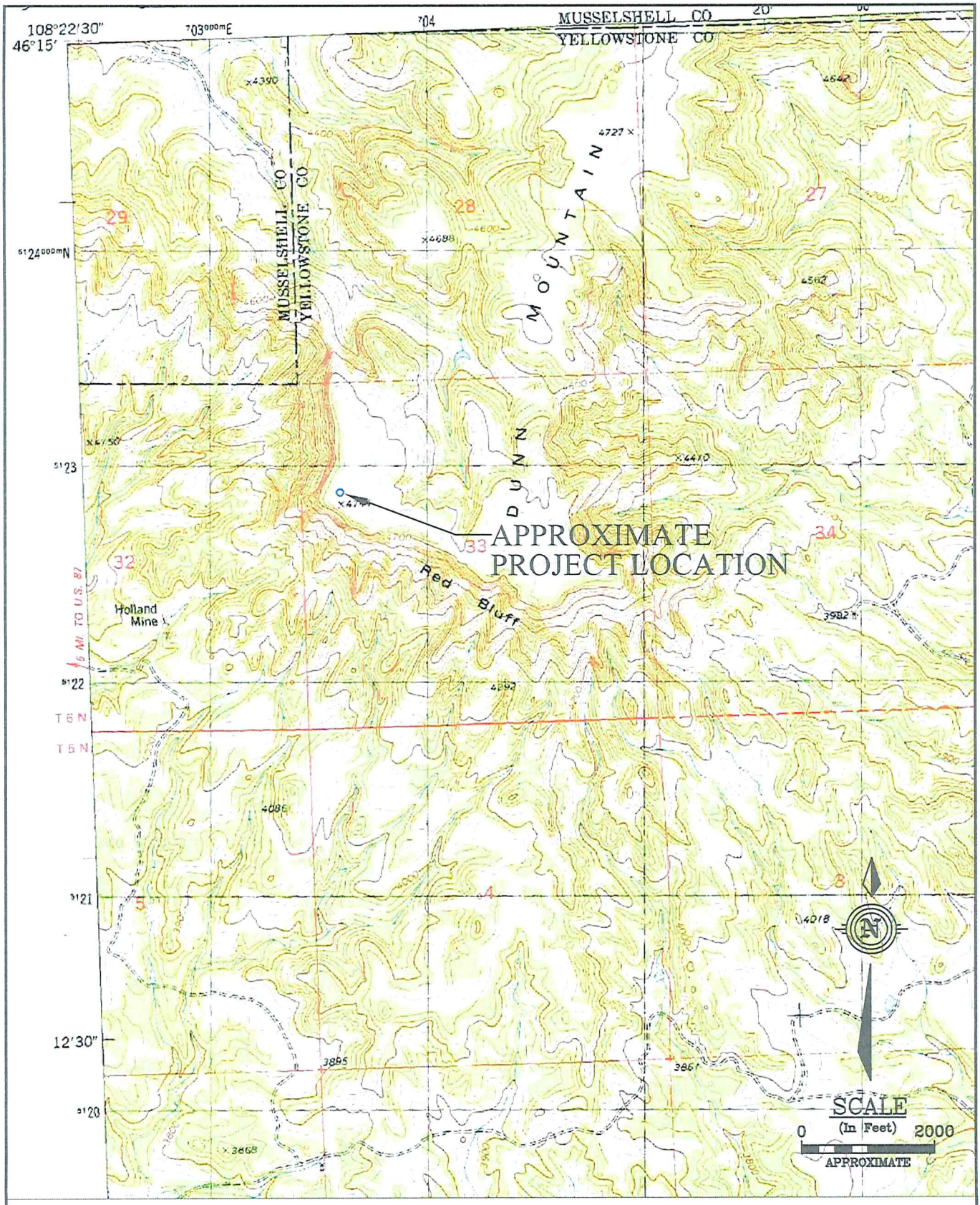
If you have any questions, please do not hesitate to contact us. As recommended above, this office should review foundation plans to help determine if the recommendations in this report have been followed. We appreciate the opportunity to provide services for your project. We look forward to working with you in the future.

Sincerely,

GEOSCIENCE, PLLP

Jordan L. Grover, P.E.
Attachments (2)

Attachment 1
Location, Site, & Geologic Maps



BASE TOPOGRAPHIC MAP FROM DUNN MOUNTAIN SOUTH 7.5 MINUTE QUADRANGLE, YELLOWSTONE COUNTY, MONTANA

Geotechnical Design Summary **Proposed Dunn Mountain Tower** **NW 1/4 Sec. 33, T. 6 N., R. 27 E.** **Yellowstone County, Montana**	PROJECT LOCATION MAP	FIGURE 1

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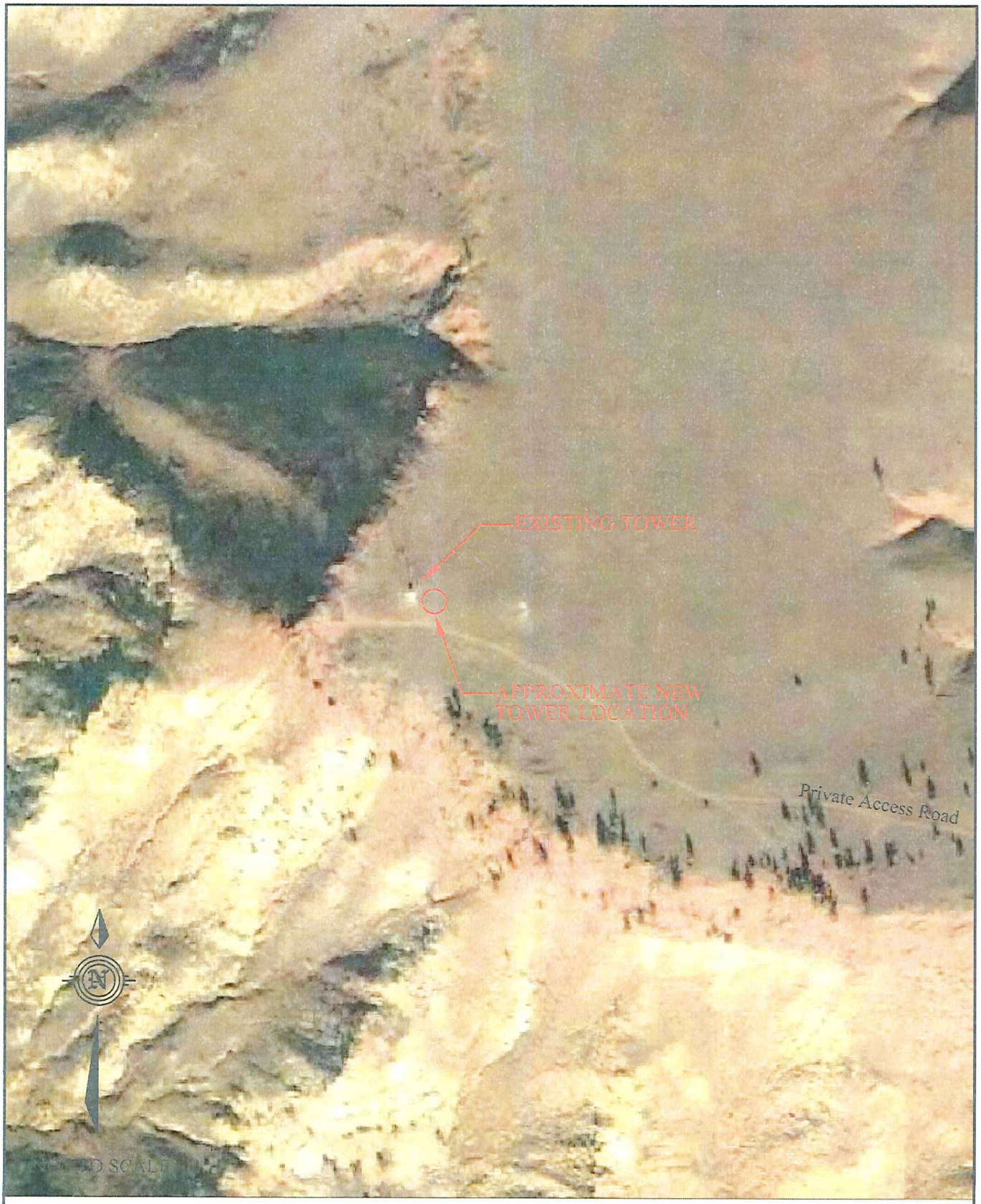
GEOSCIENCE, PLLP



BASE AERIAL MAP FROM GOOGLE EARTH, DUNN MOUNTAIN AREA, YELLOWSTONE COUNTY, MONTANA

Geotechnical Design Summary Proposed Dunn Mountain Tower NW 1/4 Sec. 33, T. 6 N., R. 27 E. Yellowstone County, Montana	SITE MAP	FIGURE 2

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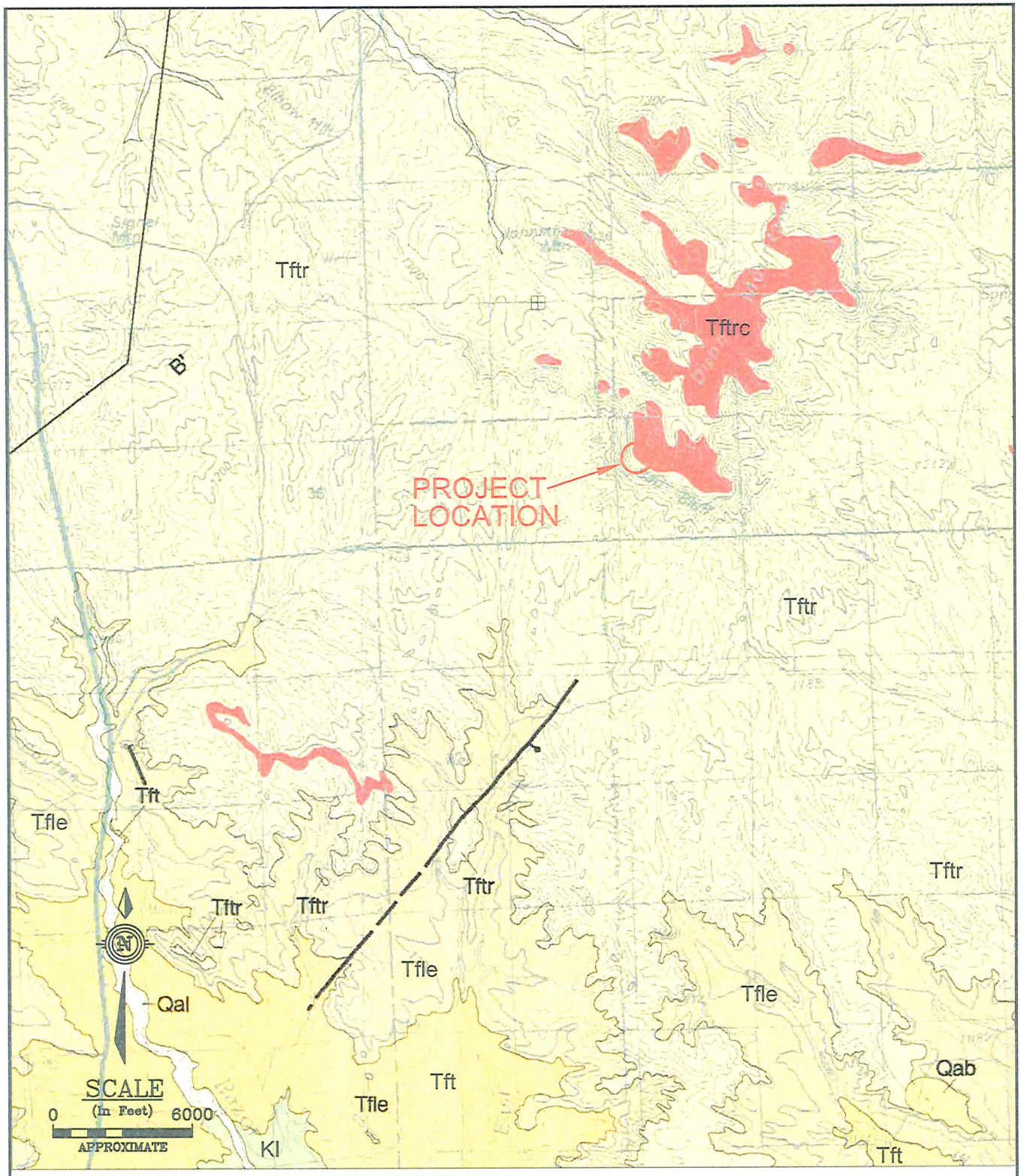
GEOSCIENCE, PLLP



GEOLOGIC MAP OF THE ROUNDUP 30'X60' QUADRANGLE, SOUTH-CENTRAL MONTANA (Wilde & Porter, 2000)

MAP UNITS:
Qal - Alluvium - Modern Stream Deposits
Qab - Alluvium of Braid Plains

Fort Union Formation:
Tftrc - Clinker
Tftr - Tongue River Member Sandstone
Tfle - Lebo Member Shale
Tft - Tullock Member Sandstone
Kl - Lance Formation - Shale & Sandstone

Geotechnical Design Summary Proposed Dunn Mountain Tower NW 1/4 Sec. 33, T. 6 N., R 27 E. Yellowstone County, Montana	GEOLOGIC MAP	FIGURE 3

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GEOSCIENCE, PLLP

Attachment 2
Site Photos

Photo 1 – View direction west. Proposed tower site in foreground, existing tower in background.

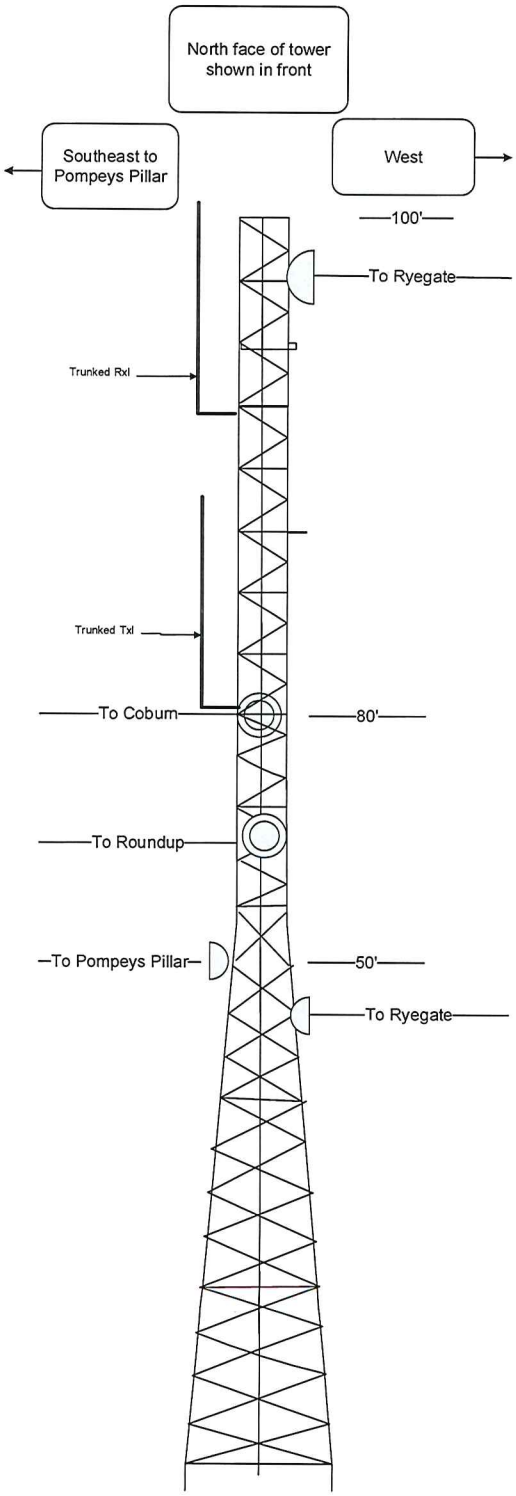
Photo 2 – Clinker (baked and fused sandstone) outcrop south of tower site.

EXHIBIT "B"

Existing Tower Structural Design Report

Dunn Mountain Radio Site

100 FT TOWER
46° 13' 50.9 "N
108° 21' 39.0 "W
NAD83 Datum



Microwave Dish Locations

To Cobum (32.3 mi)
- Direction – 188.63°
- 6 ft Dish at 80 ft.

To Pompeys Pillar (23.07 mi)
- Direction –126.66°
- 8 ft Dish at 50 ft.

Future path to Roundup Airport (`19 Miles)
- Direction –??°
- ? ft Dish at ? ft.

Future path to Ryegate (`44 Miles)

VHF Frequencies

Yellowstone County
Transmit ??? MHz
Receive ??? MHz

Musselshell County
Transmit ??? MHz
Receive ??? MHz

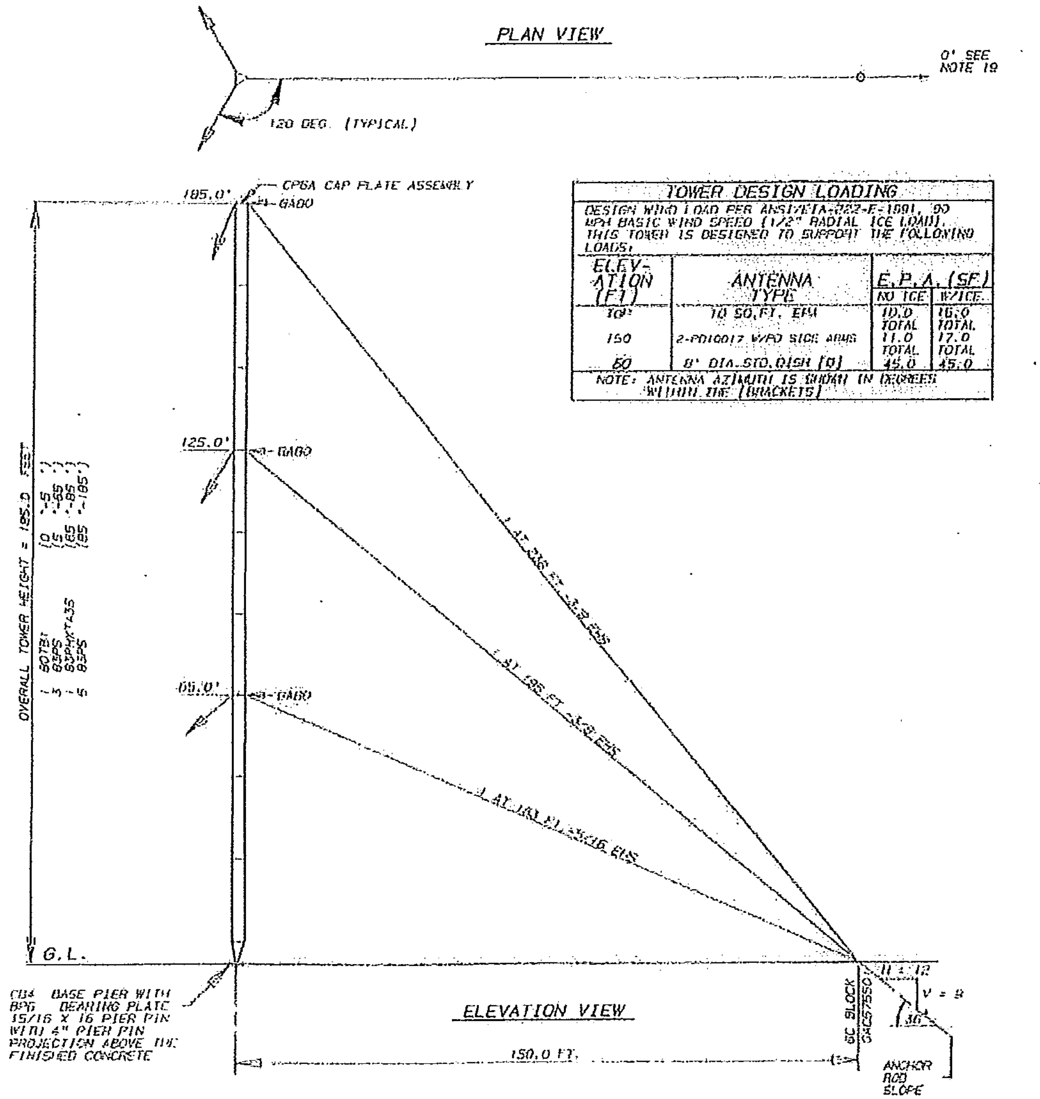
IMTC Standard Microwave Minimum Dish Loading Specification

Six (6) ten (10) foot dish antennas with radomes at the following locations:
One on each of the three legs at the 90 ft level,
One on each leg at 40 feet
Primary frequency 6 gig

Eleven (11), twenty one (21) foot radio antennas (LMR 600) using 3' side arm mount @ the following locations:
Two (2) on top of tower,
Three (3), one on each leg, 30 ft. below the top of the tower
Three (3), one on each leg, at 60 ft.' level above the ground
Three (3), one on each leg, 30 ft. level above the ground

EXHIBIT "B"

1 page



BILL OF MATERIALS					
ITEM	QTY.	UNIT	PART NO.	ITEM DESCRIPTION	DWG. NO.
1	1	EA.	80TB1	5' WELDED TAPERED BASE	[illegible]
2	8	EA.	83PS	20' NO. 80 TOWER SECTION	[illegible]
3	1	EA.	83PHXTA35	20' NO. 80 TOWER SECTION	[illegible]
4	3	EA.	GA80	GUY ASSEMBLY (BRACKET W/TORQUE ARMS)	[illegible]
5	1	EA.	BPG	BEARING PLATE	N/A
6	1	EA.	15/16X16PP	PIER PIN FOR TAPERED BASE	N/A
7	550	LF.	5/16EHS	5/16" EHS GUY WIRE	N/A
8	1450	LF.	3/8EHS	3/8" EHS GUY WIRE	N/A
9	9	EA.	3/4TBEJ	3/4" TURNBUCKLE, EYE & JAW	N/A
10	6	EA.	BG2146	5/16 BIG GRIP W/KEEPER	[illegible]
11	12	EA.	BG2147	3/8 BIG GRIP W/KEEPER	[illegible]
12	6	EA.	7/16HVT	7/16 HVY THIMBLE	N/A
13	12	EA.	1/2HVT	1/2 HVY THIMBLE	N/A
14	1	EA.	REF	FOUNDATION AND ANCHOR TOLERANCE	[illegible]
15	1	EA.	REF	ANTENNA ATTACHMENT DETAIL	[illegible]
16	3	EA.	TBSAFETY	TURNBUCKLE SAFETY DEVICE	[illegible]
17	1	EA.	REF	BOLT INSTALLATION ASSY	A790135
18	1	EA.	REF	STEP BOLT DETAIL	[illegible]
19	1	EA.	CPGA	CAP PLATE ASSY	[illegible]
20	9	EA.	[illegible]	GUY WIRE GROUND CLAMP (5/16-3/8)	C731105
21	1	EA.	REF	NORMAL SOIL FOUNDATION NOTES	[illegible]
22	2	EA.	BGK1	BASE GROUNDING KIT	C731104
23	1	EA.	AGK1	ANCHOR GROUNDING KIT	C731105
24	3	EA.	GAC575501	ANCHOR ROD	[illegible]
25	3.0	C.Y.	N/A	6C ANCHOR BLOCK - 3 AT 1.0 C.Y. EA.	[illegible]
26	2.1	C.Y.	N/A	CB4 BASE PIER - 1 AT 2.1 C.Y.	[illegible]
27	5.1	C.Y.	N/A	TOTAL CONCRETE REQUIRED	N/A

TOWER DESIGN LOADING			
DESIGN WIND LOAD PER ANSI/EIA-222-E-1991, 90 MPH BASIC WIND SPEED (1/2" RADIAL ICE LOAD). THIS TOWER IS DESIGNED TO SUPPORT THE FOLLOWING LOADS:			
ELEV-ATION (FT)	ANTENNA TYPE	E.P.A. (SF) NO ICE	E.P.A. (SF) W/ICE
TOP	10 SQ.FT. EPA	10.0 TOTAL	16.0 TOTAL
150	2-PD10017 W/PD SIDE ARMS	11.0 TOTAL	17.0 TOTAL
60	8' DIA. STD. DISH [0]	45.0	45.0
NOTE: ANTENNA AZIMUTH IS SHOWN IN DEGREES WITHIN THE [BRACKETS]			

GENERAL NOTES

1. ROHN COMMUNICATION TOWER DESIGNS CONFORM TO E.I.A.-222-E UNLESS OTHERWISE SPECIFIED UNDER TOWER DESIGN LOADING. TOWER DESIGN MAY OR MAY NOT CONFORM TO LOCAL, STATE, OR FEDERAL REQUIREMENTS.
2. THE DESIGN LOADING CRITERIA INDICATED HAS BEEN PROVIDED TO ROHN. THE DESIGN LOADING CRITERIA HAS BEEN ASSUMED TO BE BASED ON SITE-SPECIFIC DATA IN ACCORDANCE WITH ANSI/EIA-222-E AND MUST BE VERIFIED BY OTHERS PRIOR TO INSTALLATION.
3. 10 PERCENT WILL BE ADDED TO THE GUY LENGTH SHOWN FOR THE FINISHED CUT LENGTHS.
4. THE TURNBUCKLE SAFETY METHOD WILL BE USED. REFER TO THE LATEST REVISION OF DRAWING B880324 FOR INSTALLATION.
5. REFER TO THE LATEST REVISIONS OF THE DRAWINGS SHOWN IN THE BILL OF MATERIALS.
6. PAL NUTS ARE PROVIDED FOR ALL TOWER BOLTS (SEE DWG. A790135).
7. IT SHALL BE THE RESPONSIBILITY OF THE ERECTOR TO TEMPORARILY GUY THE STRUCTURE WHEN REQUIRED DURING ERECTION TO MAINTAIN THE STABILITY OF THE STRUCTURE AND TO PREVENT OVERLOADING ANY MEMBER OF THE STRUCTURE.
8. FABRICATION DRAWINGS IF REFERENCED, ARE FOR SHOP USE ONLY.
9. WORK SHALL BE IN ACCORDANCE WITH E.I.A.-222-E, "STRUCTURAL STANDARDS FOR STEEL ANTENNA TOWERS AND ANTENNA SUPPORTING STRUCTURES".
10. TOLERANCE ON TOWER STEEL HEIGHT IS EQUAL TO PLUS 1% OR MINUS 1/2%.
11. PURCHASER SHALL VERIFY THE INSTALLATION IS IN CONFORMANCE WITH LOCAL, STATE, AND FEDERAL REQUIREMENTS FOR OBSTRUCTION MARKING AND LIGHTING.
12. TOWER MEMBER DESIGN DOES NOT INCLUDE STRESSES DUE TO ERECTION SINCE ERECTION EQUIPMENT AND CONDITIONS ARE UNKNOWN. DESIGN ASSUMES COMPETENT AND QUALIFIED PERSONNEL WILL ERECT THE TOWER.
13. ROHN SHALL HAVE THE OPTION TO REVIEW FINAL DISH LOCATIONS, AZIMUTHS AND MOUNTS TO VERIFY THAT ASSUMED TORQUE VALUES, AND LOCAL STRESSES ARE NOT EXCEEDED.
14. TOWER ORIENTATION TO BE DETERMINED BY OTHERS.
15. DESIGN ASSUMES PD TYPE ANTENNAS ARE MOUNTED SYMMETRICALLY TO MINIMIZE TORQUE.
16. DISH MOUNTS ARE TO BE PROVIDED BY OTHERS.
17. SIDE ARMS ARE TO BE PROVIDED BY OTHERS.
18. DISH AZIMUTHS SHOWN ARE NOMINAL AZIMUTHS USED FOR DESIGN. ACTUAL AZIMUTHS (TO BE DETERMINED BY OTHERS) MUST NOT RESULT IN INCREASED DESIGN LOADS.
19. THE TOWER AZIMUTH SHOWN IS A RELATIVE AZIMUTH USED TO ESTABLISH THE RELATIVE POSITION OF ANTENNAS WITH RESPECT TO THE TOWER FOR DESIGN.
20. STEP BOLTS ARE PROVIDED FOR CLIMBING THE ENTIRE HEIGHT OF TOWER.
21. DESIGN ASSUMES LEVEL GRADE AT TOWER SITE.
22. INITIAL INSTALLATION OF THIS TOWER WILL NOT INCLUDE A TORQUE ARM AT THE 65' ELEVATION. A 5/16 EHS GUY WIRE WILL BE INSTALLED AT THE 65' ELEVATION. THE TORQUE ARM WILL BE ADDED IN THE FUTURE WHEN THE 8' DISH AT 50' ELEVATION IS ADDED TO THE TOWER.

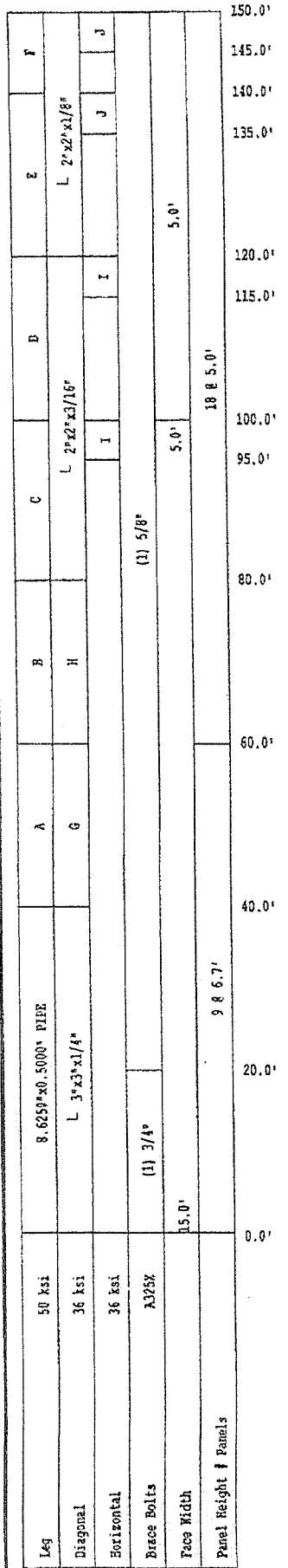
GUY WIRE DATA								
GUY ELEVATION	SIZE (IN)	TYPE	ULT. STR. (LBS)	IN. T. (LBS)		TURN-BUCKLE	SHACKLE (IN)	THIMBLE (IN)
65	5/16	EHS	11200.0	1120.0		3/4"	--	7/16 HVY
125, 185	3/8	EHS	15400.0	1540.0		3/4"	--	1/2 HVY

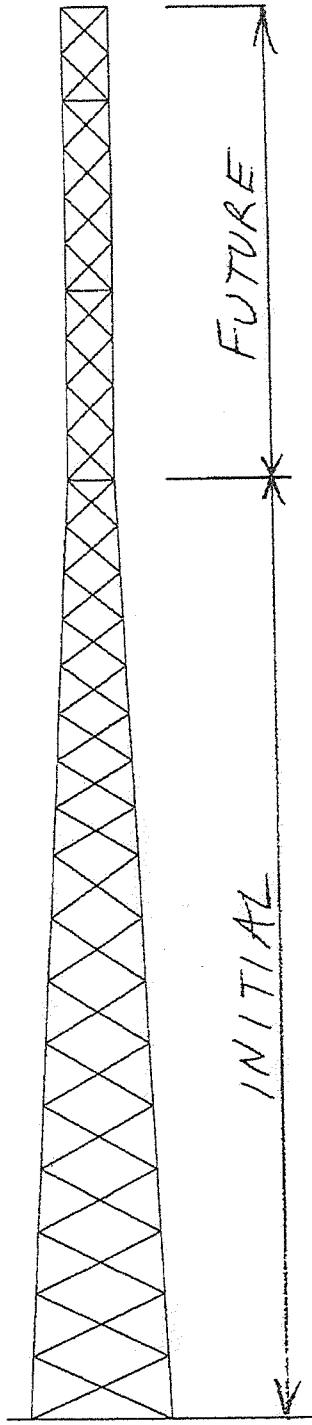
TOWER SITE: BILLINGS, MT.

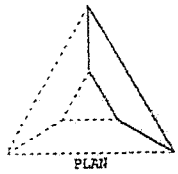
REACTIONS		
AT	VERT. (↓)	HORIZ. (↔)
BASE=0.0 FT	35.0 KIPS	
150.0 FT	-12.6 KIPS	17.5 KIPS

No. & Revision Description	& Date & Rev. By & Chk By & Appd. By
THIS DRAWING IS THE PROPERTY OF ROHN. IT IS NOT TO BE REPRODUCED, COPIED OR TRACED IN WHOLE OR IN PART WITHOUT OUR WRITTEN CONSENT.	ROHN

	By	Date	Title:
Scale: NONE			185' NO. 80 TOWER ASSEMBLY FOR CONOCO, INC.
Drawn:	CER	8/24/93	
Checked:	WDH	8-27-93	
App. Engr.:	TS	8-27-93	
App. Sales:	[illegible]	8-27-93	ENG. FILE: 30165AE; DRAWING NO.: C931000







NOTES:
1. The tower model is S37L Series HD1.
2. Transmission lines are to be attached to standard 12 hole single rail waveguide ladders.
3. Azimuths are relative (not based on true north).
4. Foundation loads shown are maximums.
5. (6) 1 1/2" dia. F1554 grade 105 anchor bolts per leg. Minimum 58" embedment from top of concrete to top of nut.
6. All unequal angles are oriented with the short leg vertical.

ANTENNA LIST

NO	ELEV	ANTENNA	TX-LINE
1	160.5'	(3) 21' Omni	
2	150'	(3) 3ft Sidearms	(3) LMR 600
3	130.5'	(3) 21' Omni	
4	120'	(3) 3ft Sidearms	(3) LMR 600
5	110.5'	(2) 21' Omni	
6	100'	(2) 3ft Sidearms	(2) LMR 600
7	94'	(1) 6' Solid Dish W/ Radome	(1) EW63
8	90'	(3) 10' Solid Dish W/ Radome	(3) EW63
9	70'	(3) 21' Omni + (3) 3ft Sidearms	(3) LMR 600
10	60'	(3) 21' Omni + (3) 3ft Sidearms	(3) LMR 600
11	40'	(3) 10' Solid Dish W/ Radome	(3) EW63
12	30'	(3) 21' Omni + (3) 3ft Sidearms	(3) LMR 600

MATERIAL LIST

NO	TYPE
A	5.5625"x0.5000" PIPE
B	5.5625"x0.3750" PIPE
C	4.5000"x0.3370" PIPE
D	4.0000"x0.3180" PIPE
E	2.8750"x0.2030" PIPE
F	2.3750"x0.1540" PIPE
G	L 2-1/2"x2-1/2"x1/4"
H	L 2-1/2"x2-1/2"x3/16"
I	L 2"x2"x3/16"
J	L 2"x2"x1/8"

STATE OF MONTANA
KEITH J. TINDALL
No. 14026 PE
LICENSED PROFESSIONAL ENGINEER

9/14/09

TOTAL FOUNDATION LOADS

H=63.14k
V=43.21k
M=4652.27k-ft
T=5.33k-ft

INDIVIDUAL FOOTING LOADS

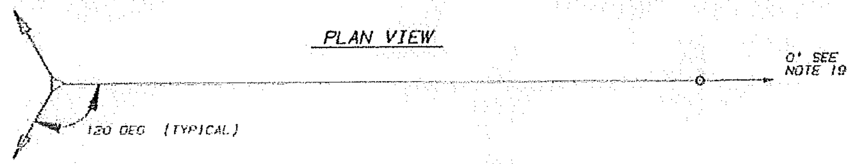
H=37.53k
V=372.53k
U=-310.37k

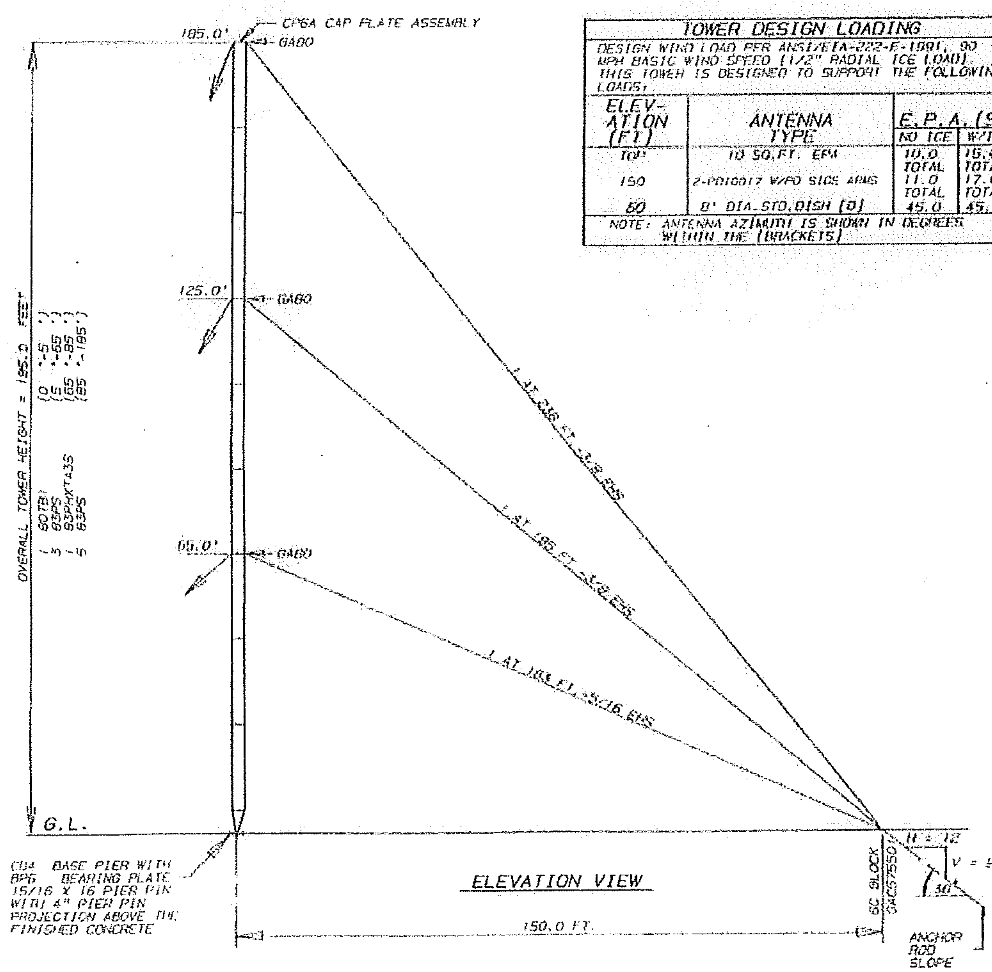
Sabre Towers & Poles

Sabre Towers And Poles
2101 Murray Street (P.O. Box 658), Sioux City, IA 51111
Phone: (712) 258-6690 Fax: (712) 258-8250

Client: INTEROPERABILITY MONTANA Job No: 10-09020 Date: 3 sep 2009
Location: Dunn Mountain, MT Total Height: 150.00' Tower Height: 150.00'
Standard: EIA/TIA 222-F-1996 Design Wind & Ice: 100 mph + 1" ice (concurrent)

PLAN VIEW





ELEVATION VIEW

TOWER DESIGN LOADING			
DESIGN WIND LOAD PER ANSI/EIA-222-E-1991, 90 MPH BASIC WIND SPEED (1/2" RADIAL ICE LOAD). THIS TOWER IS DESIGNED TO SUPPORT THE FOLLOWING LOADS:			
ELEVATION (FT)	ANTENNA TYPE	E.P.A. (SF) NO ICE	E.P.A. (SF) W/ICE
TOP	10 SQ.FT. EPA	10.0 TOTAL	15.0 TOTAL
150	2-PD10017 W/FO SIDE ARMS	11.0 TOTAL	17.0 TOTAL
60	8' DIA. STD. DISH [0]	45.0	45.0
NOTE: ANTENNA AZIMUTH IS SHOWN IN DEGREES WITHIN THE [BRACKETS]			

BILL OF MATERIALS

ITEM	QTY.	UNIT	PART NO.	ITEM DESCRIPTION	DWG. NO.
1	1	EA.	80TB1	5' WELDED TAPERED BASE	C811059
2	8	EA.	85PS	20' NO. 80 TOWER SECTION	C801228
3	1	EA.	80PHXTA35	20' NO. 80 TOWER SECTION	C900952
4	3	EA.	GA80	GUY ASSEMBLY (BRACKET W/TORQUE BARS)	C850051
5	1	EA.	BP6	BEARING PLATE	N/A
6	1	EA.	15/16X16PP	PIER PIN FOR TAPERED BASE	N/A
7	550	LF.	5/16EHS	5/16" EHS GUY WIRE	N/A
8	1450	LF.	3/8EHS	3/8" EHS GUY WIRE	N/A
9	9	EA.	3/4TBEJ	3/4" TURNBUCKLE - EYE & JAW	N/A
10	6	EA.	BG2146	5/16 BIG GRIP W/KEEPER	B200807
11	12	EA.	BG2147	3/8 BIG GRIP W/KEEPER	B200807
12	6	EA.	7/16THM	7/16 HVY THIMBLE	N/A
13	12	EA.	1/2THM	1/2 HVY THIMBLE	N/A
14	1	EA.	REF	FOUNDATION AND ANCHOR TOLERANCE	A810214
15	1	EA.	REF	ANCHOR ATTACHMENT DETAIL	B820511
16	3	EA.	TBSAFETY	TURNBUCKLE SAFETY DEVICE	B680324
17	1	EA.	REF	BOLT INSTALLATION ASSY	A790135
18	1	EA.	REF	STEP BOLT DETAIL	D651204
19	1	EA.	CP6A	CAP PLATE ASSY	B760230
20	9	EA.	340020	GUY WIRE GROUND CLAMP (5/16-3/8)	C731105
21	1	EA.	REF	NORMAL SOIL FOUNDATION NOTES	D841300
22	2	EA.	BGK1	BASE GROUNDING KIT	C731109
23	1	EA.	AGK1	ANCHOR GROUNDING KIT	C731105
24	3	EA.	GAC57550I	ANCHOR ROD	C860415
25	3.0	C.Y.	N/A	6C ANCHOR BLOCK-3 AT 1.0 C.Y. EA.	C620643
26	2.1	C.Y.	N/A	CB4 BASE PIER - 1 AT 2.1 C.Y.	C810521
27	5.1	C.Y.	N/A	TOTAL CONCRETE REQUIRED	N/A

GENERAL NOTES

1. ROHN COMMUNICATION TOWER DESIGNS CONFORM TO E.I.A.-222-E UNLESS OTHERWISE SPECIFIED UNDER TOWER DESIGN LOADING. TOWER DESIGN MAY OR MAY NOT CONFORM TO LOCAL, STATE, OR FEDERAL REQUIREMENTS.
2. THE DESIGN LOADING CRITERIA INDICATED HAS BEEN PROVIDED TO ROHN. THE DESIGN LOADING CRITERIA HAS BEEN ASSUMED TO BE BASED ON SITE-SPECIFIC DATA IN ACCORDANCE WITH ANSI/EIA-222-E AND MUST BE VERIFIED BY OTHERS PRIOR TO INSTALLATION.
3. 10 PERCENT WILL BE ADDED TO THE GUY LENGTH SHOWN FOR THE FINISHED CUT LENGTHS.
4. THE TURNBUCKLE SAFETY METHOD WILL BE USED. REFER TO THE LATEST REVISION OF DRAWING B680324 FOR INSTALLATION.
5. REFER TO THE LATEST REVISIONS OF THE DRAWINGS SHOWN IN THE BILL OF MATERIALS.
6. PAL NUTS ARE PROVIDED FOR ALL TOWER BOLTS (SEE DWG. A790135).
7. IT SHALL BE THE RESPONSIBILITY OF THE ERECTOR TO TEMPORARILY GUY THE STRUCTURE WHEN REQUIRED DURING ERECTION TO MAINTAIN THE STABILITY OF THE STRUCTURE AND TO PREVENT OVERLOADING ANY MEMBER OF THE STRUCTURE.
8. FABRICATION DRAWINGS, IF REFERENCED, ARE FOR SHOP USE ONLY.
9. WORK SHALL BE IN ACCORDANCE WITH E.I.A.-222-E, "STRUCTURAL STANDARDS FOR STEEL ANTENNA TOWERS AND ANTENNA SUPPORTING STRUCTURES".
10. TOLERANCE ON TOWER STEEL HEIGHT IS EQUAL TO PLUS 1% OR MINUS 1/2%.
11. PURCHASER SHALL VERIFY THE INSTALLATION IS IN CONFORMANCE WITH LOCAL, STATE, AND FEDERAL REQUIREMENTS FOR OBSTRUCTION MARKING AND LIGHTING.
12. TOWER MEMBER DESIGN DOES NOT INCLUDE STRESSES DUE TO ERECTION SINCE ERECTION EQUIPMENT AND CONDITIONS ARE UNKNOWN. DESIGN ASSUMES COMPETENT AND QUALIFIED PERSONNEL WILL ERECT THE TOWER.
13. ROHN SHALL HAVE THE OPTION TO REVIEW FINAL DISH LOCATIONS, AZIMUTHS AND MOUNTS TO VERIFY THAT ASSUMED TORQUE VALUES, AND LOCAL STRESSES ARE NOT EXCEEDED.
14. TOWER ORIENTATION TO BE DETERMINED BY OTHERS.
15. DESIGN ASSUMES PD TYPE ANTENNAS ARE MOUNTED SYMMETRICALLY TO MINIMIZE TORQUE.
16. DISH MOUNTS ARE TO BE PROVIDED BY OTHERS.
17. SIDE ARMS ARE TO BE PROVIDED BY OTHERS.
18. DISH AZIMUTHS SHOWN ARE NOMINAL AZIMUTHS USED FOR DESIGN. ACTUAL AZIMUTHS (TO BE DETERMINED BY OTHERS) MUST NOT RESULT IN INCREASED DESIGN LOADS.
19. THE TOWER AZIMUTH SHOWN IS A RELATIVE AZIMUTH USED TO ESTABLISH THE RELATIVE POSITION OF ANTENNAS WITH RESPECT TO THE TOWER FOR DESIGN.
20. STEP BOLTS ARE PROVIDED FOR CLIMBING THE ENTIRE HEIGHT OF TOWER.
21. DESIGN ASSUMES LEVEL GRADE AT TOWER SITE.
22. INITIAL INSTALLATION OF THIS TOWER WILL NOT INCLUDE A TORQUE ARM AT THE 68' ELEVATION. A 5/16 EHS GUY WIRE WILL BE INSTALLED AT THE 65' ELEVATION. THE TORQUE ARM WILL BE ADDED IN THE FUTURE WHEN THE 8' DISH AT 50' ELEVATION IS ADDED TO THE TOWER.

GUY WIRE DATA								
GUY ELEVATION	SIZE (IN)	TYPE	ULT. STR. (LBS)	IN. T. (LBS)		TURNBUCKLE	SHACKLE (IN)	THIMBLE (IN)
65	5/16	EHS	11200.0	1120.0		3/4"	---	7/16 HVY
125, 185	3/8	EHS	15400.0	1540.0		3/4"	---	1/2 HVY

TOWER SITE: BILLINGS, MT.

REACTIONS		
AT	VERT. (↓)	HORIZ. (↔)
BASE-0.0 FT	35.0 KIPS	
150.0 FT	12.6 KIPS	17.5 KIPS

No.	Revision Description	Date	Rev By	Chk By	Appd By

ROHN

Scale: NONE	By	Date
Drawn:	CSR	8/24/93
Checked:	WDL	8-27-93
App. Eng.:	TS	8-27-93
App. Sales:	SHN	8-27-93

Title: 185' NO. 80 TOWER ASSEMBLY FOR CONOCO, INC.

ENG. FILE: 30165AE

DRAWING NO.: C931000

Sabre™ Towers & Poles

Structural Design Report

100' Extendible to 150' S3TL Series HD1 Self-Supporting Tower
located at: Dunn Mountain, MT

prepared for: INTEROPERABILITY MONTANA
by: Sabre Towers & Poles ™

Job Number: 10-09020

September 14, 2009

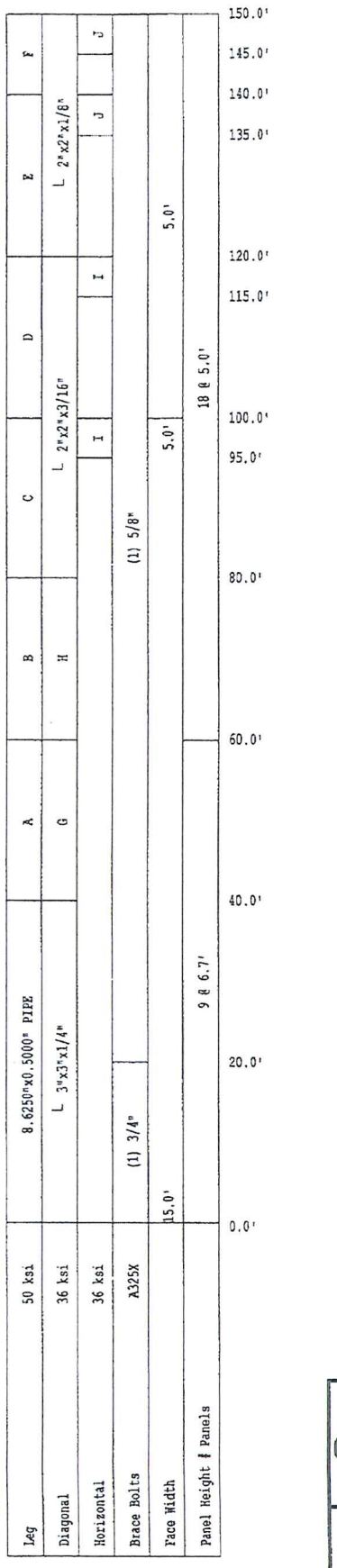
STATE OF MONTANA
KEITH J. TINDALL
No. 14026 PE
LICENSED PROFESSIONAL ENGINEER

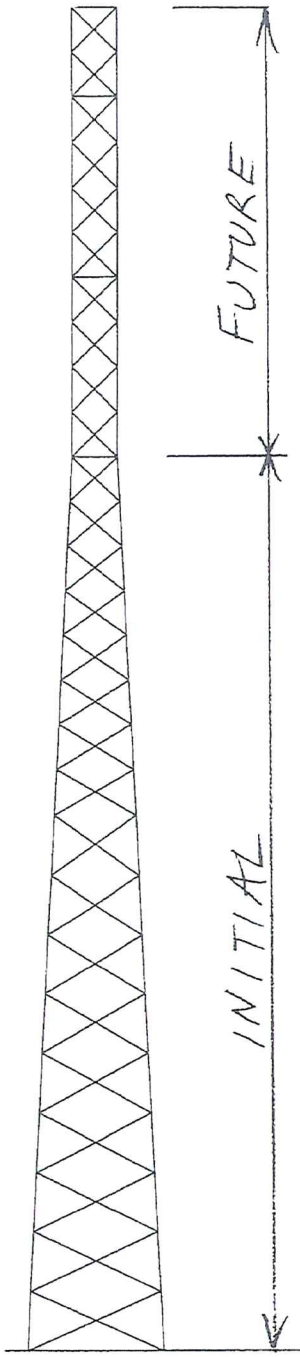
9/17/09

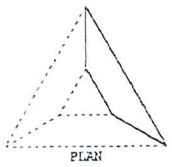
Tower by TRJ

Foundation by NJS

Approved by KJT







NOTES:
1. The tower model is S3TL Series HD1.
2. Transmission lines are to be attached to standard 12 hole single rail waveguide ladders.
3. Azimuths are relative (not based on true north).
4. Foundation loads shown are maximums.
5. (6) 1 1/2" dia. F1554 grade 105 anchor bolts per leg. Minimum 58" embedment from top of concrete to top of nut.
6. All unequal angles are oriented with the short leg vertical.

ANTENNA LIST

NO	ELEV	ANTENNA	TX-LINE
1	160.5'	(3) 21' Omni	
2	150'	(3) 3ft Sidearms	(3) LMR 600
3	130.5'	(3) 21' Omni	
4	120'	(3) 3ft Sidearms	(3) LMR 600
5	110.5'	(2) 21' Omni	
6	100'	(2) 3ft Sidearms	(2) LMR 600
7	94'	(1) 6' Solid Dish W/ Radome	(1) EW63
8	90'	(3) 10' Solid Dish W/ Radome	(3) EW63
9	70'	(3) 21' Omni + (3) 3ft Sidearms	(3) LMR 600
10	60'	(3) 21' Omni + (3) 3ft Sidearms	(3) LMR 600
11	40'	(3) 10' Solid Dish W/ Radome	(3) EW63
12	30'	(3) 21' Omni + (3) 3ft Sidearms	(3) LMR 600

MATERIAL LIST

NO	TYPE
A	5.5625"x0.5000" PIPE
B	5.5625"x0.3750" PIPE
C	4.5000"x0.3370" PIPE
D	4.0000"x0.3180" PIPE
E	2.8750"x0.2030" PIPE
F	2.3750"x0.1540" PIPE
G	L 2-1/2"x2-1/2"x1/4"
H	L 2-1/2"x2-1/2"x3/16"
I	L 2"x2"x3/16"
J	L 2"x2"x1/8"

STATE OF MONTANA
KEITH J. TINDALL
No. 14026 PE
LICENSED PROFESSIONAL ENGINEER

9/14/09

TOTAL FOUNDATION LOADS

H=63.14k
V=43.21k
M=4652.27k-ft
T=5.33k-ft

INDIVIDUAL FOOTING LOADS

H=37.53k
V=372.53k
U=-310.37k

Sabre Towers & Poles

Sabre Towers And Poles

2101 Murray Street (P.O. Box 658), Sioux City, IA 51111

Phone: (712) 258-6690 Fax: (712) 258-8250

Client: INTEROPERABILITY MONTANA | Job No: 10-09020 | Date: 3 sep 2009

Location: Dunn Mountain, MT | Total Height: 150.00' | Tower Height: 150.00'

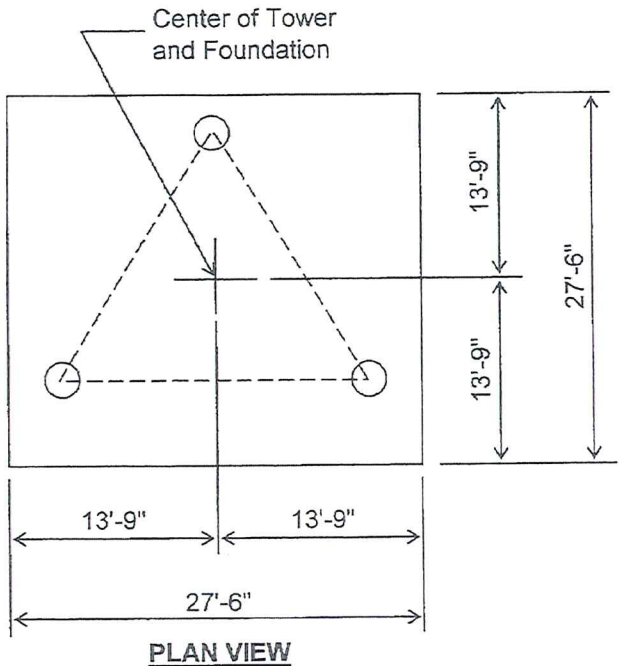
Standard: EIA/TIA 222-F-1996 | Design Wind & Ice: 100 mph + 1" ice (concurrent)

Sabre™ Towers & Poles

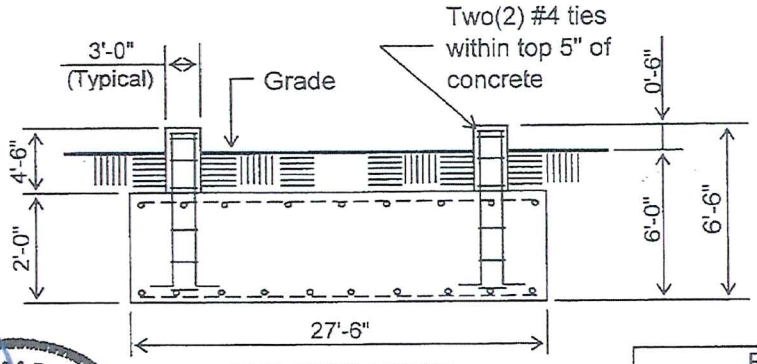
No.: 10-09020
2
Date: 9/14/09
By: NJS

Customer: INTEROPERABILITY MONTANA
Site: Dunn Mountain, MT

100 ft. Ext. to 150 ft. Model S3TL Series HD1 Self Supporting Tower At
100 mph Wind + 1 in. Ice (concurrent) per ANSI/TIA/EIA-222-F-1996.
Antenna Loading per Page 1



PLAN VIEW



ELEVATION VIEW
(59.55 Cu. Yds.)
(1 REQUIRED; NOT TO SCALE)

Notes:

1). Concrete shall have a minimum 28-day compressive strength of 3000 PSI, in accordance with ACI 318-05.

2). Rebar to conform to ASTM specification A615 Grade 60.

3). All rebar to have a minimum of 3" concrete cover.

4). All exposed concrete corners to be chamfered 3/4".

5). The foundation design is based on the geotechnical report by Geoscience; Dated 12/02/08.

6). See the geotechnical report for compaction requirements, if specified.

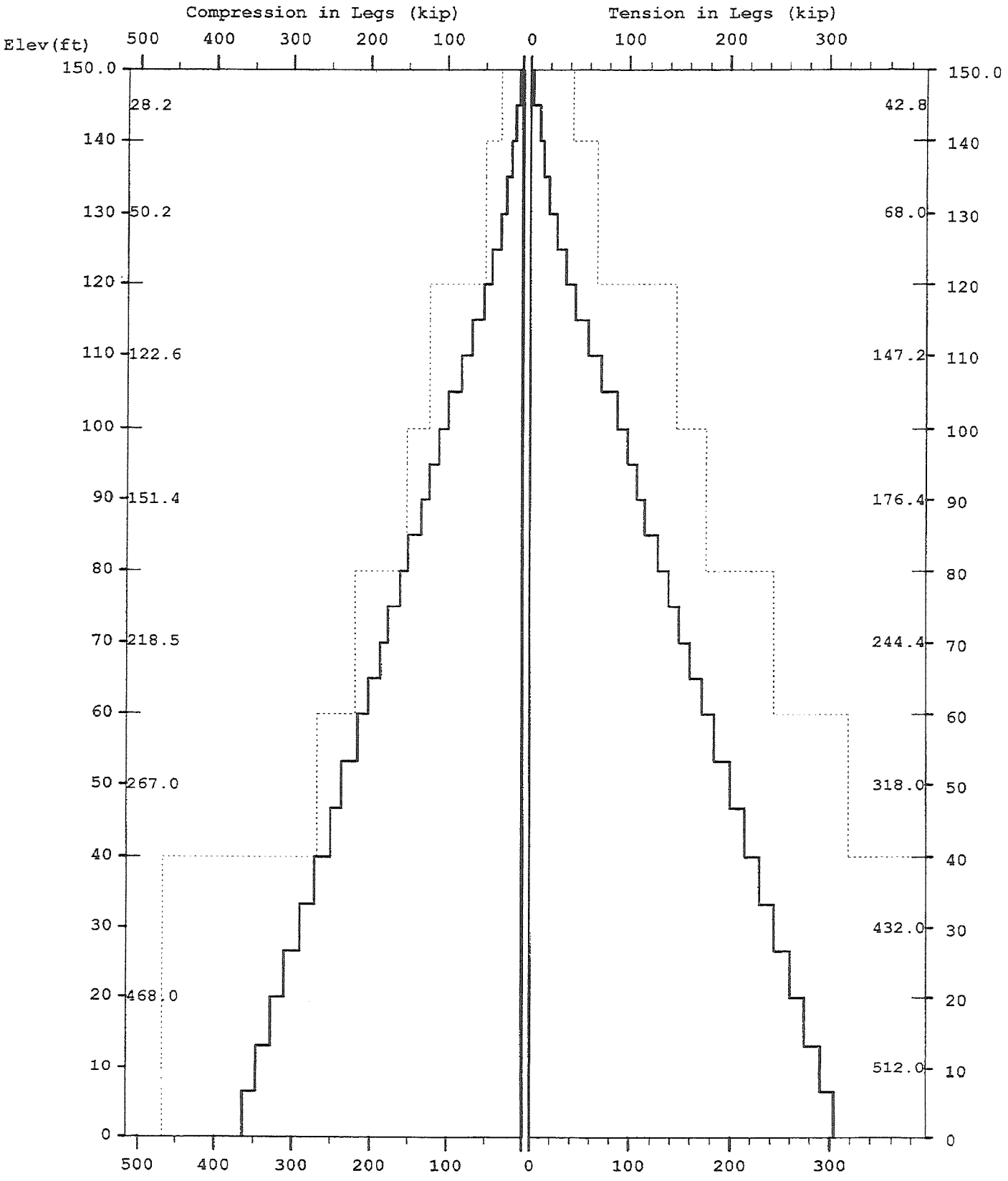
Rebar Schedule per Mat and per Pier	
Pier	(14) #8 vertical rebar w/hooks at bottom w/#4 Rebar ties, two (2) within top 5" of pier then 12" C/C
Mat	(44) #8 horizontal rebar evenly spaced each way top and bottom. (176 total)

STATE OF MONTANA
KEITH J. TINDALL
No. 14026 PE
LICENSED PROFESSIONAL ENGINEER

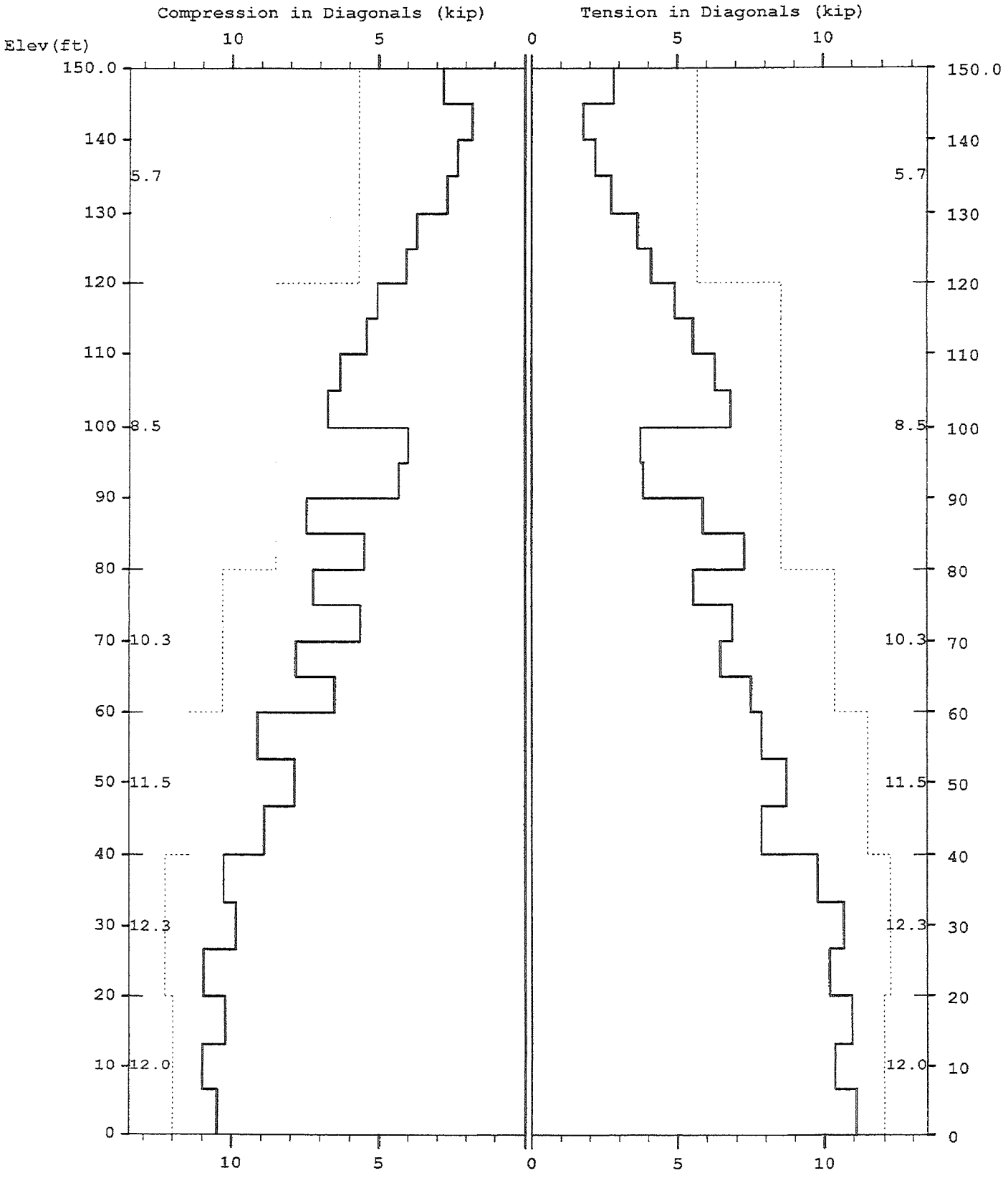
9/14/09

2101 Murray St - P.O.Box 658 - Sioux City, IA 51102-0658 - Phone 712.258.6690 - Fax 712.258.8250

100' ext. to 150' S3TL INTEROPERABILITY MONTANA Dunn Mountain MT (10-09020)
Maximum

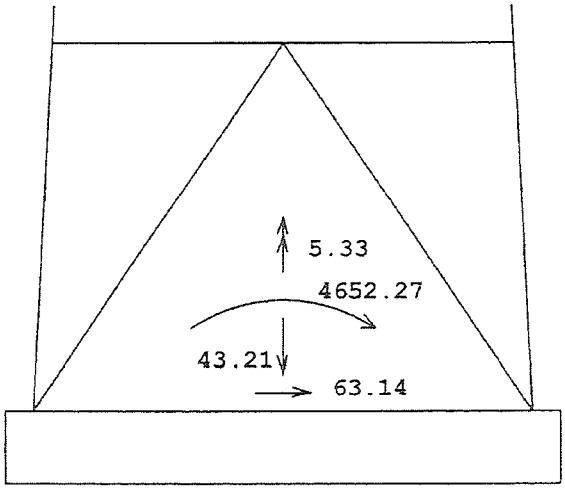


100' ext. to 150' S3TL INTEROPERABILITY MONTANA Dunn Mountain MT (10-09020)
Maximum

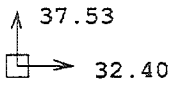


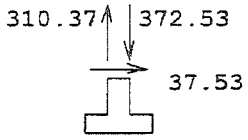
100' ext. to 150' S3TL INTEROPERABILITY MONTANA Dunn Mountain MT (10-09020)
Maximum

TOTAL FOUNDATION LOADS (kip, ft-kip)



INDIVIDUAL FOOTING LOADS (kip)





MAST - Latticed Tower Analysis (Unguyed) (c)1997 Guymast Inc. 416-736-7453
Processed under license at:

Sabre Towers And Poles on: 3 sep 2009 at: 11:30:26

100' ext. to 150' S3TL INTEROPERABILITY MONTANA Dunn Mountain MT (10-09020) T

MAST GEOMETRY (ft)

PANEL TYPE	NO.OF LEGS	ELEV.AT BOTTOM	ELEV.AT TOP	F.W..AT BOTTOM	F.W..AT TOP	TYPICAL PANEL HEIGHT
X	3	145.00	150.00	5.00	5.00	5.00
X	3	140.00	145.00	5.00	5.00	5.00
X	3	135.00	140.00	5.00	5.00	5.00
X	3	120.00	135.00	5.00	5.00	5.00
X	3	115.00	120.00	5.00	5.00	5.00
X	3	100.00	115.00	5.00	5.00	5.00
X	3	95.00	100.00	5.50	5.00	5.00
X	3	80.00	95.00	7.00	5.50	5.00
X	3	60.00	80.00	9.00	7.00	5.00
X	3	40.00	60.00	11.00	9.00	6.67
X	3	20.00	40.00	13.00	11.00	6.67
X	3	0.00	20.00	15.00	13.00	6.67

MEMBER PROPERTIES

MEMBER TYPE	BOTTOM ELEV ft	TOP ELEV ft	X-SECTN AREA in.sq	RADIUS OF GYRAT in	ELASTIC MODULUS ksi	THERMAL EXPANSN /deg
LE	140.00	150.00	1.075	0.000	29000.	0.0000000
LE	120.00	140.00	1.704	0.000	29000.	0.0000000
LE	100.00	120.00	3.678	0.000	29000.	0.0000000
LE	80.00	100.00	4.407	0.000	29000.	0.0000000
LE	60.00	80.00	6.111	0.000	29000.	0.0000000
LE	40.00	60.00	7.952	0.000	29000.	0.0000000
LE	0.00	40.00	12.763	0.000	29000.	0.0000000
DI	120.00	150.00	0.484	0.000	29000.	0.0000000
DI	80.00	120.00	0.715	0.000	29000.	0.0000000
DI	60.00	80.00	0.902	0.000	29000.	0.0000000
DI	40.00	60.00	1.187	0.000	29000.	0.0000000
DI	0.00	40.00	1.437	0.000	29000.	0.0000000
HO	145.00	150.00	0.484	0.000	29000.	0.0000000
HO	135.00	140.00	0.484	0.000	29000.	0.0000000
HO	115.00	120.00	0.715	0.000	29000.	0.0000000
HO	95.00	100.00	0.715	0.000	29000.	0.0000000

* 12 wind directions were analyzed. Only one condition is shown in full.

LOADING CONDITION A

100 MPH + 1 ICE WIND AZ 0 DEGREES

MAST LOADING
==========

LOAD TYPE	ELEV ft	APPLY..LOAD..AT RADIUS ft	AZI	LOAD AZI	.....FORCES..... HORIZ kip	DOWN kip	.....MOMENTS..... VERTICAL ft-kip	TORSNAL ft-kip
C	160.5	0.00	0.0	0.0	1.46	0.19	0.00	0.00
C	150.0	0.00	0.0	0.0	0.98	0.75	0.00	0.00
C	130.5	0.00	0.0	0.0	1.38	0.19	0.00	0.00
C	120.0	0.00	0.0	0.0	0.92	0.75	0.00	0.00
C	110.5	0.00	0.0	0.0	0.86	0.13	0.00	0.00
C	100.0	0.00	0.0	0.0	0.80	0.50	0.00	0.00
C	70.0	0.00	0.0	0.0	1.91	0.94	0.00	0.00
C	60.0	0.00	0.0	0.0	1.82	0.94	0.00	0.00
C	30.0	0.00	0.0	0.0	1.54	0.94	0.00	0.00
D	150.0	0.00	0.0	0.0	0.18	0.10	0.00	0.00
D	145.0	0.00	0.0	0.0	0.18	0.10	0.00	0.00
D	145.0	0.00	0.0	0.0	0.16	0.08	0.00	0.00
D	140.0	0.00	0.0	0.0	0.16	0.08	0.00	0.00
D	140.0	0.00	0.0	0.0	0.18	0.11	0.00	0.00
D	135.0	0.00	0.0	0.0	0.18	0.11	0.00	0.00
D	135.0	0.00	0.0	0.0	0.16	0.09	0.00	0.00
D	120.0	0.00	0.0	0.0	0.16	0.09	0.00	0.00
D	120.0	0.00	0.0	0.0	0.21	0.14	0.00	0.00
D	115.0	0.00	0.0	0.0	0.21	0.14	0.00	0.00
D	115.0	0.00	0.0	0.0	0.19	0.12	0.00	0.00
D	100.0	0.00	0.0	0.0	0.19	0.12	0.00	0.00
D	100.0	0.00	0.0	0.0	0.22	0.15	0.00	0.00
D	95.0	0.00	0.0	0.0	0.22	0.15	0.00	0.00
D	95.0	0.00	0.0	0.0	0.22	0.13	0.00	0.00
D	90.0	0.00	0.0	0.0	0.22	0.13	0.00	0.00
D	90.0	0.00	0.0	0.0	0.25	0.14	0.00	0.00
D	80.0	0.00	0.0	0.0	0.25	0.14	0.00	0.00
D	80.0	0.00	0.0	0.0	0.26	0.18	0.00	0.00
D	70.0	0.00	0.0	0.0	0.26	0.18	0.00	0.00
D	70.0	0.00	0.0	0.0	0.26	0.19	0.00	0.00
D	60.0	0.00	0.0	0.0	0.26	0.19	0.00	0.00
D	60.0	0.00	0.0	0.0	0.25	0.21	0.00	0.00
D	40.0	0.00	0.0	0.0	0.25	0.22	0.00	0.00
D	40.0	0.00	0.0	0.0	0.26	0.30	0.00	0.00
D	20.0	0.00	0.0	0.0	0.26	0.31	0.00	0.00
D	20.0	0.00	0.0	0.0	0.27	0.32	0.00	0.00
D	0.0	0.00	0.0	0.0	0.28	0.33	0.00	0.00

ANTENNA LOADING
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.....ANTENNA..... TYPE	ELEV ft	AZI	ATTACHMENT RAD ft	AZI	.....ANTENNA FORCES..... AXIAL kip	SHEAR kip	GRAVITY kip	TORSION ft-kip
STD+R	94.0	0.0	4.7	0.0	1.01	0.00	0.52	0.00
STD+R	90.0	240.0	5.0	240.0	-0.51	1.09	1.47	4.95
STD+R	90.0	0.0	5.0	0.0	2.71	0.00	1.47	0.00
STD+R	90.0	120.0	5.0	120.0	-0.51	-1.09	1.47	-4.95
STD+R	40.0	240.0	7.8	240.0	-0.41	0.87	1.47	3.93
STD+R	40.0	0.0	7.8	0.0	2.15	0.00	1.47	0.00
STD+R	40.0	120.0	7.8	120.0	-0.41	-0.87	1.47	-3.93

MAXIMUM MAST DISPLACEMENTS:

ELEV ft	------DEFLECTIONS (ft)----- NORTH	EAST	DOWN	--TILTS (DEG)--- NORTH	EAST	TWIST DEG
150.0	1.875 G	1.767 J	0.019 G	1.488 G	1.413 J	0.065 D
145.0	1.743 G	1.642 J	0.018 G	1.477 G	1.402 J	0.065 D
140.0	1.615 G	1.520 J	0.016 G	1.447 G	1.372 J	0.065 D
135.0	1.488 G	1.400 J	0.014 G	1.419 G	1.345 J	0.065 D
130.0	1.366 G	1.285 J	0.013 G	1.377 G	1.305 J	0.065 D
125.0	1.244 G	1.169 J	0.011 G	1.321 G	1.250 J	0.065 D
120.0	1.131 G	1.061 J	0.010 G	1.243 G	1.174 J	0.065 D
115.0	1.021 G	0.958 J	0.009 G	1.197 G	1.130 J	0.065 D
110.0	0.919 G	0.862 J	0.008 G	1.137 G	1.073 J	0.065 D
105.0	0.818 G	0.766 J	0.007 G	1.065 G	1.004 J	0.065 D
100.0	0.727 G	0.680 J	0.006 G	0.975 G	0.918 J	0.065 D
95.0	0.643 G	0.601 J	0.005 G	0.896 G	0.842 J	0.065 D
90.0	0.569 G	0.532 J	0.005 G	0.821 G	0.771 J	0.059 D
85.0	0.496 G	0.463 J	0.004 G	0.742 G	0.696 J	0.049 D
80.0	0.434 G	0.406 J	0.004 G	0.664 G	0.623 J	0.040 D
75.0	0.375 G	0.350 J	0.003 G	0.605 G	0.567 J	0.034 D
70.0	0.325 G	0.303 J	0.003 G	0.548 G	0.513 J	0.029 D
65.0	0.276 G	0.257 J	0.003 G	0.488 G	0.456 J	0.024 D
60.0	0.235 G	0.219 J	0.002 G	0.429 G	0.401 J	0.020 D
53.3	0.185 G	0.172 J	0.002 C	0.366 G	0.342 J	0.016 D
46.7	0.143 G	0.134 J	0.002 G	0.304 G	0.284 J	0.013 D
40.0	0.108 G	0.101 J	0.001 C	0.240 G	0.224 J	0.010 D
33.3	0.080 G	0.074 J	0.001 G	0.201 G	0.188 J	0.008 D
26.7	0.055 G	0.051 J	0.001 A	0.162 G	0.151 J	0.006 D
20.0	0.035 G	0.032 J	0.001 G	0.122 G	0.114 J	0.004 D
13.3	0.019 G	-0.018 D	0.001 A	0.082 G	0.076 J	0.003 D
6.7	0.007 G	-0.006 D	0.000 G	0.041 G	0.038 J	0.001 D
0.0	0.000 A	0.000 A	0.000 A	0.000 A	0.000 A	0.000 A

MAXIMUM ANTENNA AND REFLECTOR ROTATIONS:

ELEV ft	AZI deg	TYPE *	.....BEAM DEFLECTIONS (deg)..... ROLL	YAW	PITCH	TOTAL
94.0	0.0	STD+R	-0.828 J	0.064 D	-0.881 G	0.831 J
90.0	240.0	STD+R	-0.779 B	0.061 J	-0.819 K	0.779 B
90.0	0.0	STD+R	-0.771 J	0.059 D	-0.821 G	0.773 J
90.0	120.0	STD+R	0.779 L	0.061 D	-0.819 C	0.779 L
40.0	240.0	STD+R	-0.227 B	0.010 J	-0.240 K	0.227 B
40.0	0.0	STD+R	-0.224 J	0.010 D	-0.240 G	0.225 J
40.0	120.0	STD+R	0.227 L	0.010 D	-0.240 C	0.227 L

MAXIMUM TENSION IN MAST MEMBERS (kip)

ELEV ft	LEGS	DIAG	HORIZ	BRACE
150.0	----------		1.41 K	0.00 A
	3.30 A	2.82 J		
145.0	----------		0.03 I	0.00 A
	8.65 I	1.78 J		
140.0	----------		0.07 I	0.00 A

	12.89 A	2.17 H			
135.0	----------		0.07 A	0.00 A	
	18.95 A	2.72 D			
130.0	----------		0.03 K	0.00 A	
	25.97 A	3.65 H			
125.0	----------		0.07 I	0.00 A	
	35.76 A	4.08 D			
120.0	----------		0.15 I	0.00 A	
	45.34 A	4.89 J			
115.0	----------		0.12 E	0.00 A	
	58.62 I	5.52 D			
110.0	----------		0.04 G	0.00 A	
	71.61 I	6.26 J			
105.0	----------		0.11 A	0.00 A	
	88.07 I	6.80 B			
100.0	----------		1.32 G	0.00 A	
	98.77 A	3.71 E			
95.0	----------		0.16 A	0.00 A	
	107.85 A	3.82 F			
90.0	----------		0.02 K	0.00 A	
	115.09 A	5.85 L			
85.0	----------		0.15 A	0.00 A	
	128.13 A	7.24 K			
80.0	----------		0.00 A	0.00 A	
	139.26 A	5.55 L			
75.0	----------		0.13 A	0.00 A	
	150.41 A	6.86 K			
70.0	----------		0.00 A	0.00 A	
	160.76 A	6.43 B			
65.0	----------		0.11 A	0.00 A	
	172.61 A	7.51 K			
60.0	----------		0.00 A	0.00 A	
	184.75 A	7.83 B			
53.3	----------		0.10 A	0.00 A	
	200.82 A	8.71 C			
46.7	----------		0.03 E	0.00 A	
	214.41 A	7.87 B			
40.0	----------		0.05 A	0.00 A	
	228.84 A	9.74 H			
33.3	----------		0.04 I	0.00 A	
	243.38 A	10.67 B			
26.7	----------		0.04 A	0.00 A	
	260.11 A	10.15 H			
20.0	----------		0.04 E	0.00 A	
	274.36 A	10.92 B			
13.3	----------		0.00 A	0.00 A	
	289.95 A	10.33 H			
6.7	----------		0.04 A	0.00 A	
	303.40 A	11.06 B			
0.0	----------		0.00 A	0.00 A	

MAXIMUM COMPRESSION IN MAST MEMBERS (kip)

ELEV ft	LEGS	DIAG	HORIZ	BRACE
150.0	----------		-1.42 I	0.00 A

	-4.13 C	-2.81 J			
145.0	----------		-0.02 K	0.00 A	
	-9.85 C	-1.80 J			
140.0	----------		-0.02 C	0.00 A	
	-14.57 K	-2.28 C			
135.0	----------		-0.06 K	0.00 A	
	-21.53 K	-2.66 H			
130.0	----------		-0.03 I	0.00 A	
	-29.27 K	-3.70 D			
125.0	----------		-0.06 K	0.00 A	
	-40.08 K	-4.04 H			
120.0	----------		-0.13 K	0.00 A	
	-51.02 K	-5.08 C			
115.0	----------		-0.12 K	0.00 A	
	-65.93 K	-5.43 J			
110.0	----------		-0.05 E	0.00 A	
	-80.12 C	-6.34 D			
105.0	----------		-0.11 G	0.00 A	
	-98.38 C	-6.73 F			
100.0	----------		-1.62 A	0.00 A	
	-110.71 G	-4.03 K			
95.0	----------		-0.12 G	0.00 A	
	-121.25 G	-4.34 L			
90.0	----------		-0.07 A	0.00 A	
	-132.15 G	-7.46 K			
85.0	----------		-0.09 K	0.00 A	
	-149.87 G	-5.52 L			
80.0	----------		-0.04 A	0.00 A	
	-160.00 G	-7.22 C			
75.0	----------		-0.09 K	0.00 A	
	-175.59 G	-5.64 L			
70.0	----------		-0.02 A	0.00 A	
	-186.44 G	-7.83 C			
65.0	----------		-0.08 K	0.00 A	
	-202.04 G	-6.51 B			
60.0	----------		-0.02 A	0.00 A	
	-215.28 G	-9.15 C			
53.3	----------		-0.08 K	0.00 A	
	-235.75 G	-7.86 B			
46.7	----------		-0.03 G	0.00 A	
	-250.40 G	-8.91 C			
40.0	----------		-0.06 C	0.00 A	
	-271.22 G	-10.27 B			
33.3	----------		-0.02 G	0.00 A	
	-290.61 G	-9.86 H			
26.7	----------		-0.06 K	0.00 A	
	-309.82 G	-10.95 B			
20.0	----------		-0.02 G	0.00 A	
	-328.62 G	-10.24 H			
13.3	----------		-0.01 B	0.00 A	
	-346.64 G	-11.00 B			
6.7	----------		-0.03 G	0.00 A	
	-364.35 G	-10.50 H			
0.0	----------		0.00 A	0.00 A	

MAXIMUM INDIVIDUAL FOUNDATION LOADS: (kip)
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LOAD---COMPONENTS				TOTAL
NORTH	EAST	DOWN	UPLIFT	SHEAR
37.53 G	32.40 K	372.53 G	-310.37 A	37.53 G

MAXIMUM TOTAL LOADS ON FOUNDATION : (kip & kip-ft)

HORIZONTAL			DOWN	OVERTURNING			TORSION
NORTH	EAST	TOTAL @ 0.0		NORTH	EAST	TOTAL @ 0.0	
63.1 G	58.5 J	63.1 G	43.2 C	4652.3 G	4336.4 J	4652.3 G	5.3 D

MAT FOUNDATION DESIGN BY SABRE TOWERS & POLES

Tower Description 150' S3TL Series HD1
Customer INTEROPERABILITY MONTANA
Project Number 10-09020
Date 9/14/2009
Engineer NJS

Overall Loads:			
Moment (ft-kips)	4652.3	Anchor Bolt Count (per leg)	6
Axial (kips)	43.20		
Shear (kips)	63.1		
Individual Leg Loads:			
Uplift (kips)	310.37		
Download (kips)	372.53		
Shear (kips)	37.53		
Width of Tower (ft)	15		
Allowable Bearing Pressure (ksf)	3.5	Maximum Net Bearing Pressure (ksf)	2.21
Water Table Below Grade (ft)	999		
Width of Mat (ft)	27.5	Minimum Mat Width (ft)	22.99
Thickness of Mat (ft)	2		
Depth to Bottom of Slab (ft)	6		
Bolt Circle Diameter (in)	13.25		
Top of Concrete to Top of Bottom Threads (in)	58		
Diameter of Pier (ft)	3	Minimum Pier Diameter (ft)	2.60
Ht. of Pier Above Ground (ft)	0.5	Equivalent Square b (ft)	2.66
Ht. of Pier Below Ground (ft)	4		
Quantity of Bars in Mat	44		
Bar Diameter in Mat (in)	1		
Area of Bars in Mat (in^2)	34.56		
Spacing of Bars in Mat (in)	7.51	Recommended Spacing (in)	6 to 12
Quantity of Bars Pier	14		
Bar Diameter in Pier (in)	1		
Tie Bar Diameter in Pier (in)	0.5		
Spacing of Ties (in)	12		
Area of Bars in Pier (in^2)	11.00	Minimum Pier A_s (in^2)	5.09
Spacing of Bars in Pier (in)	6.28	Recommended Spacing (in)	6 to 12
f'c (ksi)	3		
fy (ksi)	60		
Unit Wt. of Soil (kcf)	0.1		
Unit Wt. of Concrete (kcf)	0.15		
Load Factor	1.3		
Volume of Concrete (yd^3)	59.55		
Two-Way Shear:			
Average d (in)	20		
ϕV_c (kips)	578.2	V_u (kips)	484.3
$\phi V_c = \phi(2 + 4/\beta_c)f'_c{}^{1/2}b_o d$	867.2		
$\phi V_c = \phi(\alpha_s d/b_o + 2)f'_c{}^{1/2}b_o d$	946.3		
$\phi V_c = \phi 4 f'_c{}^{1/2}b_o d$	578.2		

MAT FOUNDATION DESIGN BY SABRE COMMUNICATIONS CORP. (CONTINUED)

Shear perimeter, b_o (in)	175.93		
β_c	1		
Stability:			
(Resisting M)/1.5 (ft-k)	5248.6	Total Applied M (ft-k)	5062.5
One-Way Shear:			
ϕV_c (kips)	542.2	V_u (kips)	506.3
Pier Design:			
Design Tensile Strength (kips)	593.8	Ultimate Tensile Load (kips)	403.5
ϕV_n (kips)	60.1	V_u (kips)	48.8
$\phi V_c=\phi 2(1+N_u/(500A_g))f'_c{}^{1/2}b_wd$	17.7		
V_s (kips)	56.5	*** V_s max = 4 $f'_c{}^{1/2}b_wd$ (kips)	227.2
Maximum Spacing (in)	13.09	(Only if Shear Ties are Required)	
Actual Hook Development (in)	19.00	Req'd Hook Development l_{dh} (in)	15.34
		*** Ref. To Spacing Requirements ACI 11.5.4.3	
Anchor Bolt Pull-Out:			
$\phi P_c=\phi\lambda(2/3)f'_c{}^{1/2}(2.8A_{SLOPE}+4A_{FLAT})$	125.3	P_u (kips)	403.5
Pier Rebar Development Length (in)	47.63	Required Length of Development (in)	37.22
Flexure in Slab:			
ϕM_n (ft-kips)	2918.6	M_u (ft-kips)	2889.5
a (in)	2.46		
Steel Ratio	0.00524		
β_1	0.85		
Maximum Steel Ratio (.75p_b)	0.0160		
Minimum Steel Ratio	0.0018		
Rebar Development in Pad (in)	162.00	Required Development in Pad (in)	81.78

Condition	1 is OK, 0 Fails
Minimum Mat Width	1
Maximum Soil Bearing Pressure	1
Pier Area of Steel	1
Pier Shear	1
Two-Way Shear Action	1
Stability (Safety Factor = 1.5)	1
Anchor Bolt Pull-Out	1
Flexure	1
Steel Ratio	1
Length of Development in Pad	1
Interaction Diagram Visual Check	1
One-Way Shear	1
Hook Development	1
Minimum Mat Depth	1